

Patent claims

1. A method for the high-pressure filling of a pressure vessel with a gas or gas mixture, in which the
5 pressure vessel is cooled and filled with at least one gas at a temperature above the boiling temperature of the gas, is closed in the cooled state and a pressure is produced in the filled and closed pressure vessel by warming.
- 10 2. The method as claimed in claim 1, characterized in that a pressure of more than 100 bar or of more than 200 bar or of more than 300 bar is produced in the filled pressure vessel by warming the gas or gas mixture.
- 15 3. The method as claimed in claim 1 or 2, characterized in that the warming of the gas is effected by active heating or by temperature equalization to room temperature, ambient temperature, a temperature above 0°C or another temperature.
- 20 4. The method as claimed in one of claims 1 to 3, characterized in that a pure gas with a boiling temperature of less than minus 50°C or a gas mixture whose highest-boiling gas component has a boiling temperature of less than minus 50°C is used for filling.
- 25 30 5. The method as claimed in one of claims 1 to 4, characterized in that the filling of the pressure vessel takes place at a temperature of at least minus 50°C or below.
- 35 6. The method as claimed in one of claims 1 to 5, characterized in that the filling of the pressure vessel takes place at constant or substantially constant temperature.

7. The method as claimed in one of claims 1 to 6, characterized in that a cooled pressure vessel is used during the filling of the pressure vessel, the cooling 5 being effected by means of a refrigeration bath, a cooling block, a cold gas, cold solid particles or other refrigerants or a cooling device which can be thermostated.

10 8. The method as claimed in one of claims 1 to 7, characterized in that the determination and monitoring of the filling quantity during the filling operation are effected manometrically.

15 9. The method as claimed in one of claims 1 to 8, characterized in that during the filling of the pressure vessel the pressure vessel is connected to a compressed-gas source, the compressed-gas source being at a temperature which is above the temperature of the 20 pressure vessel.

10. The method as claimed in one of claims 1 to 9, characterized in that during the filling of the pressure vessel the pressure vessel is connected to a compressed-gas source, and the temperature of pressure 25 vessel and compressed-gas source differ by at least 50°C and/or the temperature of the gas or gas mixture in the pressure vessel and compressed-gas source differ by at least 50°C.

30 11. The method as claimed in one of claims 1 to 10, characterized in that the pressure vessel is filled with a gas mixture by filling with a previously produced gas mixture or by successive filling with the 35 gas components of the gas mixture that is to be produced.

12. The method as claimed in one of claims 1 to 11, characterized in that the filling of the pressure vessel is carried out with a pressurized gas or gas mixture.

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13. The method as claimed in one of claims 1 to 12, characterized in that the filling of the pressure vessel takes place at a pressure of at least 10 bar absolute.

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14. The method as claimed in one of claims 1 to 13, characterized in that the filling of the pressure vessel takes place at a pressure in the range from 50 to 400 bar absolute.

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15. The method as claimed in one of claims 1 to 14, characterized in that the filling of the pressure vessel is carried out using a precooled gas or gas mixture.

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16. The method as claimed in one of claims 1 to 15, characterized in that the gas or gas mixture is precooled to the filling temperature.

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17. The method as claimed in one of claims 1 to 16, characterized in that a pressurized refrigerant is used for the cooling, or the temperature is set, controlled or regulated during cooling by the action of pressure.

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18. The method as claimed in one of claims 1 to 17, characterized by its use in the filling of airbag gas generators.

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19. The use of a gas or gas mixture with a boiling temperature at a standard pressure of less than minus 200°C for the filling of cooled pressure vessels of airbag systems.

20. The use as claimed in claim 19, characterized in that a gas or gas mixture containing at least 50% by volume of hydrogen or helium is used.

5 21. The use of an apparatus comprising at least one compressed-gas source, at least one pressure vessel with cooling device, a connecting line between compressed-gas source and pressure vessel, and at least one valve, for filling pressure vessels of airbag
10 systems with at least one gas or gas mixture without mechanical compression.